Local Microwave Protective Detector
“Forteza-200”

Description Manual & Service Instruction
4372-43071246-065 TO

2008

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1. INTRODUCTION

The present description manual and service instruction contains information about the operation of the local microwave protective detectors “Forteza-200”, “Forteza-100”, “Forteza-50” (below the detector). In this document there is information required for the correct operation (use, transportation, storage and maintenance) of the detector.

The following abbreviations are used in the present document:

Tx - transmitter

Rx - receiver.

2. PURPOSE

2.1. The purpose of the detector is to protect the perimeter sectors and to detect an intruder crossing at his full height or bent (crawling) through this sector.

2.2. The detector is intended for continuous round-the-clock outdoor operation at an ambient temperature -40ºC…+65°C and relative humidity up to 98% at the temperature +35°C.

3. SPECIFICATIONS

3.1. The recommended length of a sector for modifications:

“Forteza-200” – 10…200 m

“Forteza-100” – 10…100 m

“Forteza-50” – 5…50 m.

3.2. The configuration and the dimensions of the detection zone are given in fig.3.1. and table 3.1.

The detection zone is a volumetric part of a sector that being the very specialty in the kind of detection, and any movement within this sector will generate an alarm.

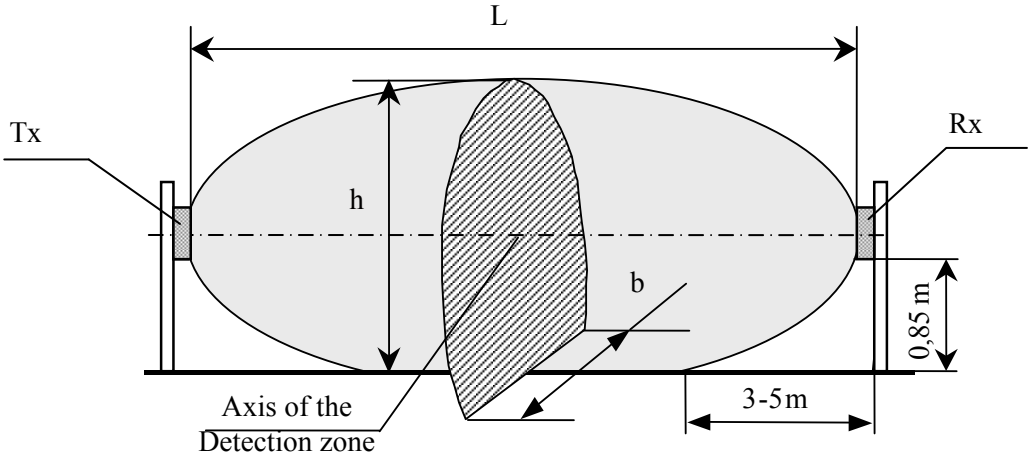


Fig.3.1.

L- Length of a sector

h- Height of detection zone

b- Width of detection zone

In fig.3.1 and table 3.1 the height (h) and the width (b) of the detection zone are given for the middle of the sector. Moving towards the receiver or transmitter these dimensions decrease evenly, given the geometry of positioning the receiver and transmitter.

Table 3.1.

Dimensions, maximum, m	**Length of a sector L, m**				
	10	**25**	**50**	**100**	**200**
h			1,4	1,6	1,8
b	0,5	0,7	1,0	1, 5	2, 1

3.3. The distance recommended from the axis of the detection zone up to guarding, building walls and other nonmoving objects should be as follows:

80…200m - 1, 1 m minimum

25…80m - 0, 8 m minimum

10…25m - 0, 4 m minimum.

3.4. The detector generates an alarm when:

- An intruder crosses a detection zone (perpendicularly to the axis) at a speed of 0, 3…10 m/sec at his full height or bent (crawling through) with the minimum detection probability of 98 %;

- RC signal is given on Tx;

- Electromagnetic field influences on Rx for its masking. An alarm can be absent but in this case the detector saves its availability.

An alarm is generated by breaking the contacts of an individual point opt electronic relay for the time 3 sec minimum. This signal is sent from Rx by yellow and pink colored wires marked “NC” (normally closed); “NC” (normally closed).

Note. *At the distance of 3-5 m from the supports on which Tx and Rx are installed, the probability of the intruder’s detection who is bent (crawls through) is 98 % because a person can move bent and pass below the detection zone.*

3.5. The detector generates a fault signal in the case:

- The absence of the signal from Tx

- In the absence of power supply or when the voltage drops below 9 V.

- Failure of Rx or Tx.

A fault signal is generated constantly (latching) till the same is rectified and indicated by break in the contacts of an individual point optoelectronic relay indicated by yellow and pink colored wires marked “NC”; “NC”.

3.6. The dimensions of an individual point optoelectronic relay are: the maximum switching current is 0,1A; the maximum voltage is 50 V; the maximum resistance is 100 Ohm in the closed status (with the elements of storm protection).

3.7. Removal/ opening of the back inspection cover of the Rx unit generate a tamper alarm. The contacts of the tamper circuit are broken and this is reflected at the Rx unit through the green and grey colored wires marked “TAMPER”, “TAMPER”. Contacts rating of this tamper circuit are: current up to 0,2A at voltage up to 80 VDC.

3.8. The detector power supply is: 9…30 VDC with a maximum pulsation of 0,02 V maximum. The maximum current consumption is 35 ma at 24 VDC.

3.9. The detector operation can be tested by applying 5…30 VDC signal at the RC on the Tx unit. The RC is marked as "RC" (remote control) input of the transmitter. The duration of this test signal is 1…3 sec.

3.10. The detector doesn't generate an alarm when:

- precipitations such as rain, snow, thick fog
- solar radiation
- the influence of wind at a speed of 30 m/sec. maximum
- moving of the objects in the DZ (detection zone) of 5 m from Rx or Tx of the objects with the linear dimensions of 0,2 m maximum (birds or small animals)
- irregularities on the sector up to ± 0, 3m
- snow without additional adjustment up to 0, 5 m
- grass up to 0, 3 m
- influence of the radiated emission of ultra short waves of the range 150-175 MHz up to 40 Vat on the distance 6 m maximum.

3.11. The detector is immune to EMI: voltage impulses in supply circuits, breaks of main supply, electrostatic discharges, and electromagnetic fields.

3.12. Input circuits of Tx and Rx are protected from electric pickup (electric storm too).

3.13. The detector mean lifetime is 8 years.

3.14. Maximum dimensions of the units without a mounting kit, mm:

Tx - 211*130*105

Rx - 211*130*105.

3.15. Maximum weight of the units with a mounting kit, kg:

Tx - 1,2

Rx - 1,2.

4. DETECTOR COMPONENTS

The detector delivery kit is:

1. Receiver – 1 item
2. Transmitter - 1 item
3. Mounting kit including:
   - Bracket – 2 items
   - Buckle – 4 items.
4. Kit of tools and accessories including:
   - Alarm cable
   - Key S8*10.
5. Description Manual & Service Instruction
6. Package.

5. DETECTOR STRUCTURE & OPERATION

5.1. Detector Principle of Operation

5.1.1. The detector is a bistatic microwave detector.

The principle of the detector operation is to generate an electromagnetic field in the space between a transmitter and a receiver. This field provides a volumetric detection zone in the form of a long ellipsoid of rotation (see fig.3.1.). An intruder crossing a detection zone causes changes of the field. All changes of this field are recorded. There is the detection zone configuration in fig.3.1, there are given in table 3.1 its crosscuts

dimensions for three performances of the detector dependency on the length of a sector with the height 0, 85 m of Rx & Tx mounting.

5.1.2. An intruder crossing a detection zone causes the change of the signal magnitude on Rx input. The signal passes through the amplifier and is compared with the value thresholds according to the algorithm. If the signal's change on Rx input is provoked by a person passage, Rx generates an alarm breaking output contact of the relay.

5.1.3. The signal on Rx input can be changed under the influence of other factors: rain, grass, small animals, electromagnetic interference, swinging of branches, gates entering the detection zone commensurable with an intruder movement. Other reasons, e.g. location of extensive constructions, objects in the detection zone or near from it like as fences, walls, irregularities, snow, grass can influence on the level of Rx input signal. In theses cases because of big reflections and interference the detection zone configuration jumps. Multi thresholds algorithm of the detector operation permits to decrease the number of alarms provoked by interference. **That's why it is necessary to observe the recommendations in the subsection 8.1!**

5.2. Adjustment, Control and Indication Parts

5.2.1. An alarm generates the values of the Rx thresholds. An explorer establishes them during the operation with the controller of the thresholds "MIN-MAX". The thresholding is realized by the main rotation of resistor axis with screwdriver. In this case the thresholds will change from minimum (MIN) to maximum (MAX) value.

5.2.2. The input signal is controlled with the tester on the socket that is marked "TEST" (test jack).The more TEST the more Rx input signal and vise versa. The detector keeps its operation with the range of the voltage values too: TEST 0,1-4,8 V.

5.2.3. The light indicator "PROTECTION" provides the indication of the mode operation of the detector:

- Continuous luminescence means the standby state of the detector;
- The indicator's switching off for 3 sec means the alarm generation.

5.2.4. During Rx and Tx adjustment on the maximums of the antennas directional diagrams, the amplifier is transferring from the mode of the adjustment with a big time constant to the mode with a small time constant by pressing the button "AGC" (automatic gain control) on Rx. In this case an express setup of the amplifier takes place on the standby state.

5.2.5. A "normally closed" tamper loop is provided to prevent unauthorized opening of the back panel of the Rx unit. In the operating condition the tamper circuit's contacts are closed, during the back panel opening they are broken. The circuits of alarm cables marked "TAMPER"; "TAMPER" (green and grey wires) are broken too.

5.3. Detector Operation

5.3.1. The detector operation provides the following suite:

- Preparation of the sector
- Signal cables and power supply laying
- Tx and Rx installation
- Detector's connection (connection of power supply and loops of intruder alarms)
- Alignment of Tx and Rx antennas

- Setup of Rx thresholds.

The principles and the methods of the operations' performance are given in items 8-10.

5.3.2. The detector has the following operating regimes:

- Standby state (contact breaking)
- Alarm signal (open condition)
- Tamper state of Rx (the contacts of the tamper circuit are opened).

5.3.3. The receiver control device realizes the receipt and the indication of alarms. The detector operates with the receiver control devices providing the check of the relay contacts.

5.3.4. During the operation the remote control checks the detector efficiency. The constant voltage 5…30 V for 1…3 sec is realized on the Tx green wire marked "RC". The beaming of Tx is interrupted for the time of the signal "RC" operation. Then Rx generates an alarm. In such a way **the signal generation after the signal "RC" confirms the detector's operation and the running order of the loop.**
The user determines the control periodicity.

5.3.5. Besides there it is necessary to check periodically the technical state of the detector and its servicing. Periodicity of the checks is given in item 11.

6. DETECTOR CONSTRUCTION

6.1. Rx Construction

6.1.1. The detector consists of separate units (Rx, Tx) placed in dust-, splash-proof enclosures.

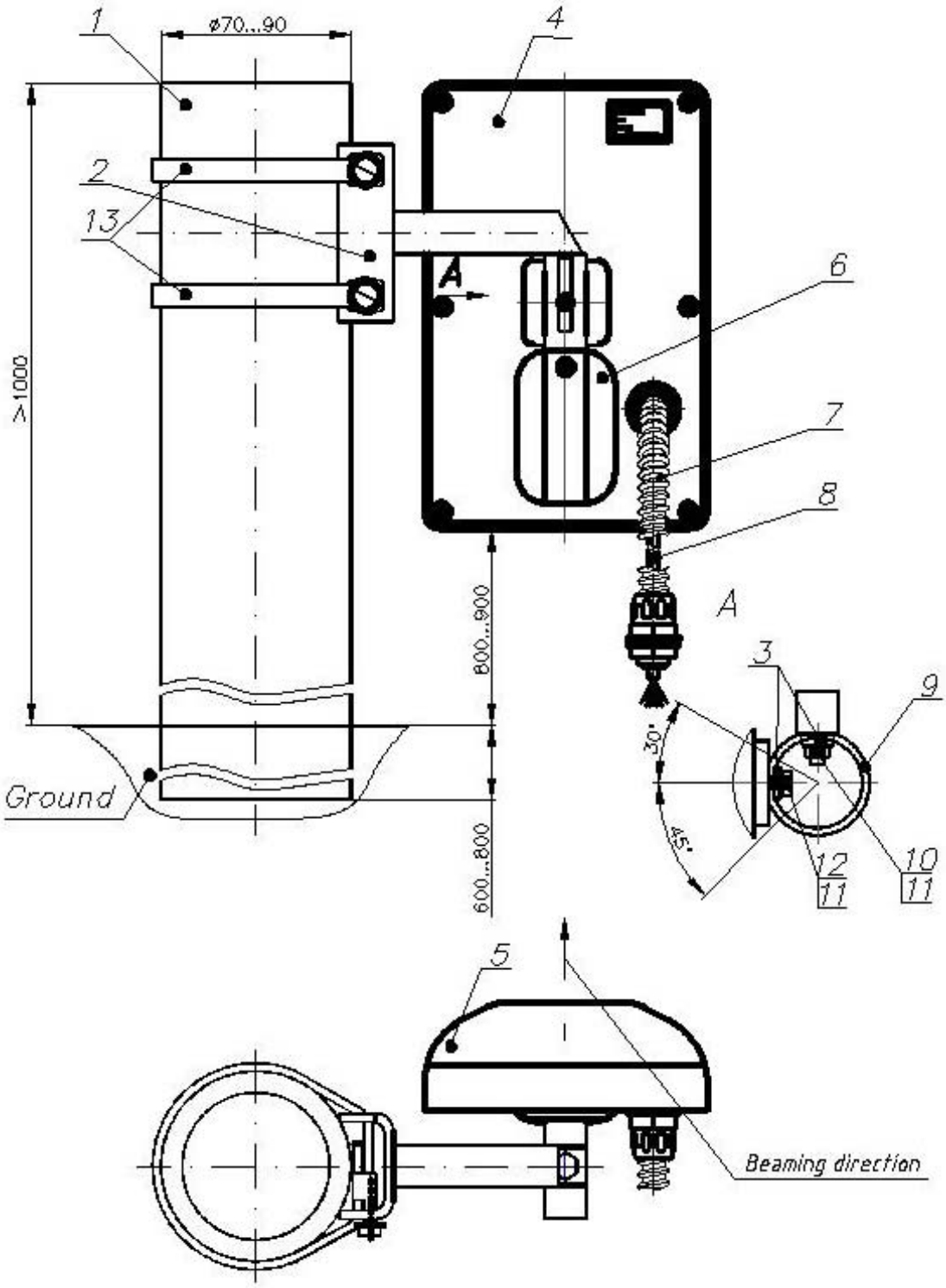
6.1.2. Rx Construction and its fastening elements to the support are given in fig. 6.1. The carrier of the unit is base 4. Radio transparent enclosure 5 is glued to the base with sealing material. In the heel of the enclosure there are two holes preventing condensed fluid accumulation within the unit. The access to the controls, adjustment, indication elements and clamps for the connection of the terminal element is open when the cover 6 is removed. Rx is connected to the receiver control device with six wires cable 8. Rx is mounted on the support 1 using the bracket 2 and two bucles13. Mounting provides the rotation of the unit horizontally at angle $\pm$65° minimum; vertically: upward - at angle 30° minimum, downward – at angle 45° minimum (if the bolt 12 is eased). Location and marking of the clamps, controls, adjustment and indication elements located under the cover 6 are shown in fig. 6.2.

6.2. Tx Construction

6.2.1. Tx construction and its bracket are the same as the Rx construction (see fig.6.1). The difference is in internal elements: cover 6, clamps, controls, adjustment and indication elements are absent; three wire cables are used instead of cable 8.

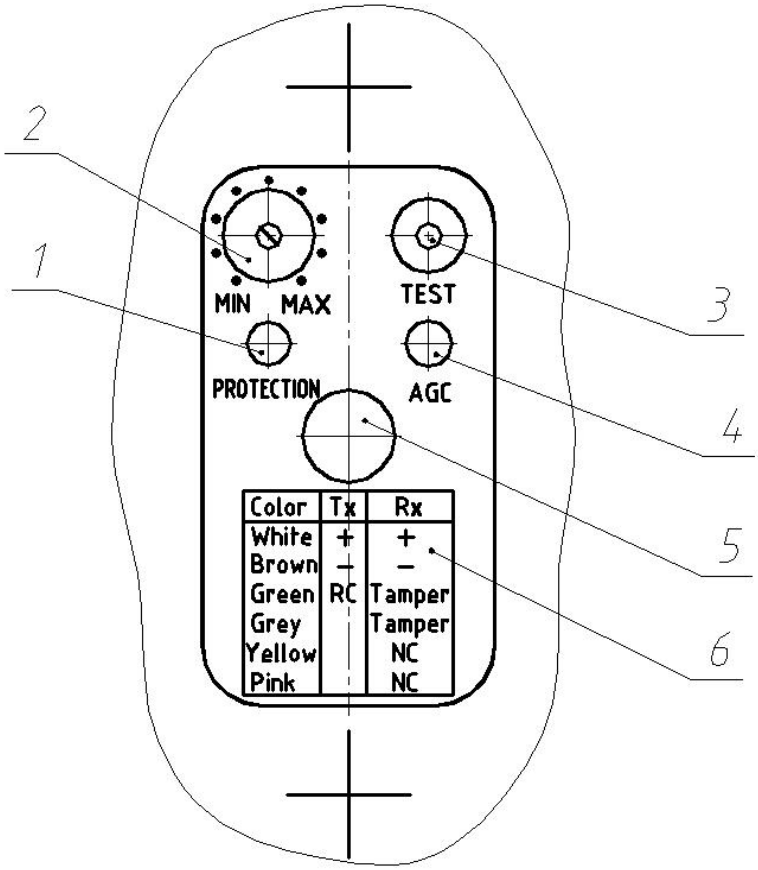
6.3. MK (mounting kit)

6.3.1. Mounting kit includes two brackets and four buckles for the mounting on the support of Rx and Tx.



1-support - 1 item
2- bracket - 1 item
3- figured washer - 2 items
4-base -1 item
5-enclosure - 1 item
6-cover -1 item
7- corrugated tube - 1 item
8-cable - 1 item
9-ring - 1 item
10-nut M6 - 1 item
11-washer 6 -2 items
12-bolt M6*16 - 1item
13-buckle- 2items

Fig.6.1



1 - indicator "PROTECTION"
2 - thresholding “MIN-MAX”
3 - socket "TEST"
4 – “AGC” button
5 - tamper circuit
6 - marking of cable cords

Fig.6.2.

Note. *Dear user! The manufacturer of the detector constantly upgrades their quality and reliability. That’s why in some lots of detectors one can find design modifications unspecified in the documents delivered with the detectors. Nevertheless, the main specifications are valid.*

7. SAFETY MEASURES

7.1. The current safety standards for the operation with electrical facilities with up to 1000 V voltage should be observed during mounting, prevention and repair of the detector.

7.2 Cables should be laid, terminated and connected to the sockets only when supply voltage is OFF.

7.3. It is prohibited to mount and to maintain the detector during lightning storm.

8. MOUNTING PROCEDURE

8.1. Requirements for the preparation of the sector and the arrangement of Rx and Tx

8.1.1. The sector where Tx and Rx are located should meet the following requirements:

a) The height of irregularities should not exceed $\pm$0,3m. If irregularities of the sector surface from the plane exceed $\pm$0,3m, the specifications of the detector can worsen. In this case the issue of the use of the detector under these conditions is defined by the trial operation.

b) The height of the grass should not exceed 0,3m;

c) The height of the snow should not exceed 0,5m;

d) The maximum incline of the sector is 45°;

e) Single fixed objects (e.g. posts, trees without lower branches) can be situated in the detection zone at the distance of 0,5 m minimum from the axis;

f) On the sector there **should not be situated** moving leaves, bushes, trees, etc. at the distance of 0,7 m from the axis connecting Tx and Rx;

g) The width of the sector should meet item 3.3.

The detector can be mounted if the width of the sector is less. In this case if "TEST" voltage (item 9.2.) is less than 1,2 V, it is necessary to change Rx and Tx position relative to the support. For example, if Rx and Tx are at the left from the support, turning the wall bracket relative to the support at 180º, fix Rx and Tx at the right from the support. If it is not successful and "TEST" voltage is less than 1, 2 V, it is necessary to realize the trial operation and according to its results to make a decision about the possibilities of the detector operation in these conditions.

8.2. Detector Mounting

8.2.1. Mark the perimeter for the places where the supports are mounted. To increase the protected area, it is necessary to provide the overlapping of the sectors (see fig.8.1. and 8.2.). The overlapping is necessary to exclude the possibility of the sector's overcoming under or above Tx (Rx) near from the support.

8.2.2. Mount the supports. It is recommended to use metal or asbestos-cement tube as supports of 70…90mm diameter. The height of the support above the surface of the ground is given in fig.6.1. In the places where there is a lot of snow, the superstructure of the support should be 1500 mm minimum.

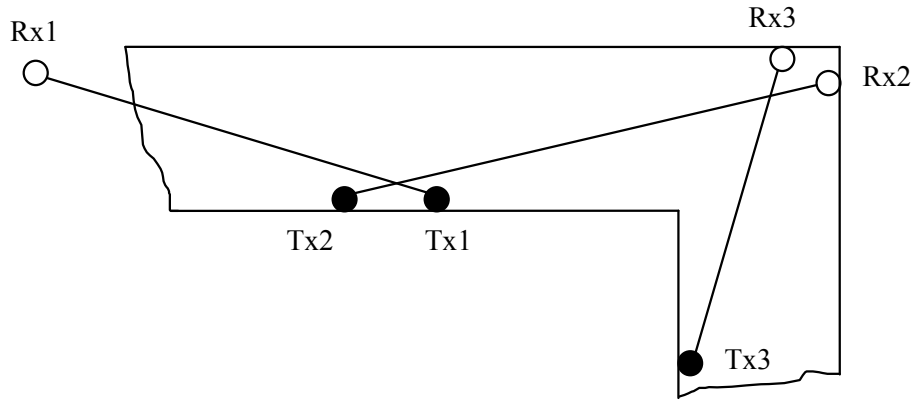


Fig.8.1

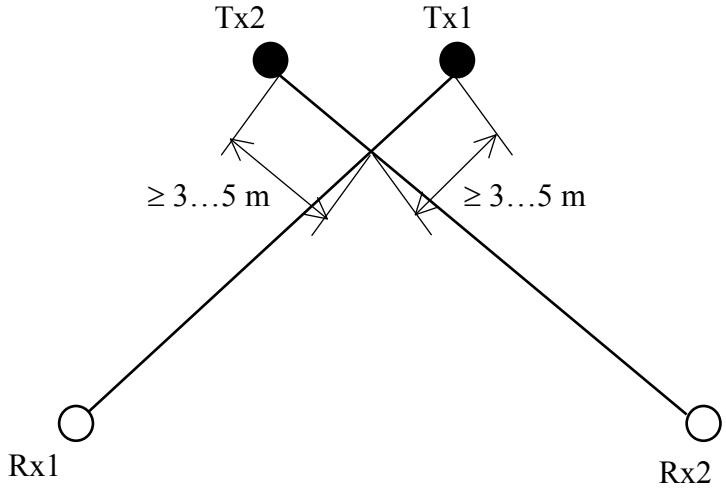


Fig.8.2

8.2.3. The supports are mounted with concreting.

The user can apply other variants of the detector mounting (for example guarding, building wall) according to the results of the trial operation. As the guarding deforms the detection zone configuration, the detector operation depends on the exact place of its mounting.

8.2.4. Lay the main cables according to the project of the security systems.

Mount the brackets on the supports for Rx and Tx. The brackets of Rx and Tx (for a sector) should be adjusted. The height of the brackets mounting (if snow is absent) is chosen according to fig.6.1. The brackets are mounted on the supports with two buckles (see fig.6.1).

8.2.5. Install Tx and Rx on the brackets with bolts 12 (fig.6.1).

ATTENTION! The right orientation of Tx and Rx on the bracket - drain port should be downward!

ATTENTION! To reduce the level of electromagnetic interference induced on supply lines it is recommended to mount SU at the distance of 300 m maximum from the place where the detectors are installed.

8.3. Detector Connection

8.3.1. Switch **ON** the necessary supply units, signal circuits, remote control circuits. Rx and Tx units are connected with its own alarm cables. The wires are marked. The marking of cable conductors is given in table 8.1.

Table 8.1

Rx			Tx		
Circuit	Color	Purpose	Circuit	Color	Purpose
"+"	red	Supply voltage	"+"	red	Supply voltage
"-"	blue		"-"	blue	
"NC"	yellow	Individual point relay contacts	"RC"	green	Remote control +5…30 V
"NC"	yellow				
"TAMPER"	green	Contacts of tamper circuit			
"TAMPER"	brown				

8.3.2. The type and the nominal of the terminal element of the security systems loop (resistor, condenser, and diode) are determined by the type of the control device. The detector is connected to the control device. Usually it is a resistor. The nominal resistance of this resistor should take into the clamping resistor of the lightning circuit (this resistor - 100 Ohm) and resistence of the security systems loop (depends on the chosen cable type and its length).

8.3.3. The contacts of the tamper circuit ("TAMPER") of Rx can be connected to the receiver control device by the separate loop. In this case the user receives the information of the opening of the Rx terminal cover with the separate signal. The second variant: the individual point relay is switched ON in series with the contacts of the individual relay. In this case an alarm will be generated when:

- the individual point relay functions;
- the opening of the Rx terminal cover on one channel of the control device.

8.3.4. The detector receives a signal from remote control ("RC") when an additional button is installed in the room. It is possible to install one button on some detectors. In this case the button pressing checks the detectors operation of all group detectors.

9. PREPARATION OF THE DETECTOR FOR THE OPERATION AND ADJUSTMENT

9.1. Detector Preparation for its Operation

Check the right connection of supply circuits and output circuits of the detector.

9.1.1. Switch ON the detector power supply. The broken or constant glowing of the indicator "PROTECTION" proves the presence of voltage on Rx.

9.2. Adjustment of Tx and Rx

9.2.1. Tx and Rx are adjusted on the angle of the place and the azimuth according to the maximum value of "TEST" voltage.

9.2.2. Two persons are necessary for adjustment. One of them is situated next to Rx, the other – next to Tx.

9.2.3. The alignment includes the following procedure:

- Connect the tester to the socket "TEST" using the alarm cable from the kit in the mode of constant voltage measuring;

- Loosen the bolts12 (see fig.6.1) of Tx and Rx;
- Press the button “AGC”. Pressing it and stooping in turn Tx and Rx vertically exact the maximum indicated value of voltmeter. Ease the button “AGC”.
- Tighten the bolts 12;
- Loosen the nuts 10;
- Press the button “AGC”. Pressing it and stooping in turn Tx and Rx horizontally exact the maximum indicated value of voltmeter. Ease the button “AGC”.
- Tighten the nuts 10;
- Check the value of “TEST” voltage as a result of the adjustment. If “TEST” voltage is less than 1,2 V, it is necessary to repeat the alignment vertically and horizontally for more exact adjustment. If the voltage controlled by the voltmeter is over 4,5V (on short sectors), it **is recommended to make the desalignment of Rx and Tx upwards at a small angle so the voltage does not exceed 4,5V. Don’t desalign Rx and Tx down or towards.** The detector keeps its operation using “TEST” voltage 0,1…4,8V. The boundary values of 1,2V and 4, 5V during the adjustment are recommended for the resource of the signal level to provide a long operation;
- Disconnect the tester from the socket “TEST” of Rx.

9.3. Rx threshold

9.3.1. Mount the controller “MIN-MAX” in the position MAX.
Thresholds are adjusted when a person crosses a protected sector uniformly along the whole length. Cross the sector in the position “at one’s full height” and “having bent”. It is necessary to go out from the DZ of 1-2 m for Rx calming (otherwise the results of the previous passage will influence on the following). When the detector generates alarms, “PROTECTION” indicator becomes to dim for 3 sec. The following passage can be done after the switching ON of the indicator “PROTECTION”. If the signal is not generated during the investigator passage, the controller “MIN-MAX” will be turned on one-two points counter-clockwise and the alignment will be continued.
Do some check passes along the whole length of the sector especially in the “problem” sector places: in hollows, hills, next to the trees branches situated in the detection zone. If it is necessary regulate the detector thresholds.

Align the thresholds very attentively as “decreasing” the thresholds a lot of false alarms can be taken place because of some interference; “increasing” the thresholds some detector’s omissions appear in its operation.
When the adjustment is over, it is necessary to close the Rx terminal cover.

After the detector adjustment it is recommended to carry out its trial operation for 2…3 days to reveal and eliminate possible errors of mounting and adjustment.

10. OPERATION OF THE DETECTOR WITH THE DEFLECTOR

10.1. If it is necessary to create breaking of the detection zone the detector can be used with the deflector (fig.10.1).

10.2. A metal sheet (its dimensions no less than 1*1m) is used as a deflector. During mounting the deflector should be adjusted at the angle of azimuth and the angle of the place. It should have reliable fastening to exclude its vibration when it is windy because it can cause false alarms.

10.3. In case of the detector operation “Forteza-200” through the deflector the total length of the detection zone does not exceed 50 m.

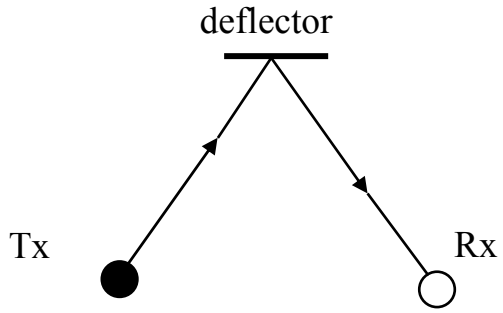


Fig.10.1

10.4. Procedure of Operation

10.4.1. Mount Tx, Rx and the deflector according to item 8.2.

10.4.2. Align Tx and Rx in the direction of the deflector. Open the Rx terminal cover and connect the tester to the socket “TEST” with the alarm cable. Switch on supply voltage.

Changing the position of the deflector, Tx and Rx units obtain the signal on the socket “TEST”. Carry out exact alignment according to item 9.2.

10.4.3. To define the optimal position of the deflector it is possible to use a laser pointer. Place a mirror on the deflector (the plane of the mirror should be parallel to the plane of the deflector) and fix the pointer (keep it) in the center of Tx unit. Direct the pointer beam on the mirror center. Changing the position of the deflector it is necessary to obtain the beam from the pointer to be in the center of Rx.

Switch on supply voltage and carry out the exact alignment of Rx, then the alignment of Tx according to the methods given in item 9.2. Adjust the operation thresholds of Rx according to methods given in item 9.3.

11. CHECK OF TECHNICAL STATE

11.1. Check of Detector Operation

11.1.1. During the detector’s exploitation it is recommended to check remote control (“RC”) 1…3 times in a day.

11.2. Servicing

11.2.1. The detector should be served by the technicians after special training and instruction.

11.2.2. During the service of the detector it is necessary to conduct check and preventive works.

11.2.3. Every month carry out external examination of the detector units and the state of the sector where Tx and Rx are installed.

It is necessary to check:

- the absence of dust, dirt, snow and ice from the side of radiation of Rx and Tx antennas and clean them if it is necessary;
- the absence of outside objects in the sector where Tx and Rx are installed.

11.2.4. Every quarter:

- carry out all the works specified as works carried out every month;
- check the state of the cables and cable connections.

11.2.5. During seasonal works it is controlled the height of the grass. If the height of the grass is over 0,3m the grass should be cut or removed by another method.

11.2.6. If the height of snow changes, false alarms can be generated because of the decrease of the signal at the input of the receiving unit. In this case it is necessary to remove snow or to change the height of Tx and Rx antennas installation.

After the height of the antenna mounting is changed, they should be aligned. The thresholds should be adjusted according to the procedure given before.

12. TROUBLESHOOTING GUIDE

List of possible troubles is given in table 12.1.

Table 12.1

Trouble	Possible Cause	Repair
1. The receiver control device constantly generates alarms	1. Communication line is broken.	Check the cable integrity and the accuracy of its connection. Restore the communication line.
	2. The protective device in the supply unit is blown.	Replace the protective device.
	3. The detector alignment is disturbed.	Align Tx and Rx antennas.
	4. Tx fails.	Replace Tx.
	5. Rx fails.	Replace Rx.
2. False alarms of the detector	1. Moving branches are in a detection zone and they cause alarms.	Inspect the sector and remove interference factors.
	2. High grass is in the sector.	
	3. Snow blanket is higher than one specified in the manual and this reduces an input signal.	
	4. Animals circulate in the sector.	
	5. The Rx thresholds are too low.	Check the accuracy of the Rx thresholds setting.
3. The	1. Rx thresholds are	Check the

Trouble	Possible Cause	Repair
detector does not generate alarms when an intruder crosses the sector.	too high.	accuracy of the Rx thresholds setting.
	2. The alignment is disturbed.	Align Tx and Rx antennas.

13. STORAGE

13.1. The detectors should be stored in the package in warehouses at an ambient temperature +5°C…+30 °C and relative humidity 85% maximum.

During storage the influence of hostile environment should be prevented.

14. TRANSPORTATION

14.1. Packaged detectors can be transported by any transport (if by plane – in pressurized modules) if they are transported in covered cars, holds or covered bodies they can be transported at the distance up to 10 000 km.

The boxes should be placed to prevent their shifting or fall in case of jolts and blows.

Microwave Local Protective Detectors
“Forteza-200”,
“Forteza-100”,
“Forteza-50”
Certificate
4372-43071246-065 ПС

The purpose of the detector and its specifications are given in the corresponding items of the description manual 4372-43071246-065 ТО.

1. DELIVERY KIT

The delivery kit includes:

Transmitter	1 item
Receiver	1 item
Mounting kit	1 kit
Kit of tools and accessories	1 kit
Description manual and Service instruction, certificate	1 item.

2. ACCEPTANCE CERTIFICATE

The detector “Forteza-200”, Forteza-100”, “Forteza-50” serial _____ meets performance specifications of 4372-43071246-065ТУ and it is considered as operable.

Date of issue _____200 .

Mark of technical control department

3. MANUFACTURER'S GUARANTEES

The manufacturer guarantees the conformity of the detector specifications to requirements ТУ 4372-43071246-065 if a user meets the service conditions and operating rules specified by 4372-43071246-065 ТО.

Warranty period is 18 months since the date of sale by the manufacturer.

Guarantees do not cover detectors:

- with broken guarantee stamps;
- with mechanical failures,
- and also those which are out of order because of natural disasters (lightning, fire, and flood).

Mean lifetime is 8 years.

Send complaints to the following address:

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